**Topics 10 - Organic Chemistry (SL/HL 1)**

**Topic 10: Organic chemistry (12 hours)**  
**10.1 Introduction - 4 hours**  
10.1.1 Describe the features of a homologous series. (2)   
10.1.2 Predict and explain the trends in boiling points of members of a homologous series. (3)   
10.1.3 Distinguish between empirical, molecular and structural formulas. (2)   
10.1.4 Describe structural isomers as compounds with the same molecular formula but with different   
arrangements of atoms. (2)   
10.1.5 Deduce structural formulas for the isomers of the non-cyclic alkanes up to C6. (3)   
10.1.6 Apply IUPAC rules for naming the isomers of the non-cyclic alkanes up to C6. (2)   
10.1.7 Deduce structural formulas for the isomers of the straight-chain alkenes up to C6. (3)   
10.1.8 Apply IUPAC rules for naming the isomers of the straight-chain alkenes up to C6. (2)   
10.1.9 Deduce structural formulas for compounds containing up to six carbon atoms with one of the   
following functional groups: alcohol, aldehyde, ketone, carboxylic acid and halide. (3)   
10.1.10 Apply IUPAC rules for naming compounds containing up to six carbon atoms with one of the   
following functional groups: alcohol, aldehyde, ketone, carboxylic acid and halide. (2)   
10.1.11 Identify the following functional groups when present in structural formulas: amino (NH2), benzene ring ( ) and esters (RCOOR). (2)   
10.1.12 Identify primary, secondary and tertiary carbon atoms in alcohols and halogenoalkanes. (2)   
10.1.13 Discuss the volatility and solubility in water of compounds containing the functional groups listed in 10.1.9. (3)   
**10.2 Alkanes - 2 hours**  
10.2.1 Explain the low reactivity of alkanes in terms of bond enthalpies and bond polarity. (3)   
10.2.2 Describe, using equations, the complete and incomplete combustion of alkanes. (2)   
10.2.3 Describe, using equations, the reactions of methane and ethane with chlorine and bromine. (2)   
10.2.4 Explain the reactions of methane and ethane with chlorine and bromine in terms of a free-radical mechanism. (3)   
**10.3 Alkenes - 2 hours**   
10.3.1 Describe, using equations, the reactions of alkenes with hydrogen and halogens. (2)   
10.3.2 Describe, using equations, the reactions of symmetrical alkenes with hydrogen halides and water. (2)   
10.3.3 Distinguish between alkanes and alkenes using bromine water. (2)   
10.3.4 Outline the polymerization of alkenes. (2)   
10.3.5 Outline the economic importance of the reactions of alkenes. (2)   
**10.4 Alcohols - 1 hour**  
10.4.1 Describe, using equations, the complete combustion of alcohols. (2)   
10.4.2 Describe, using equations, the oxidation reactions of alcohols. (2)   
10.4.3 Determine the products formed by the oxidation of primary and secondary alcohols. (3)   
**10.5 Halogenoalkanes - 2 hours**   
10.5.1 Describe, using equations, the substitution reactions of halogenoalkanes with sodium hydroxide. (2)   
10.5.2 Explain the substitution reactions of halogenoalkanes with sodium hydroxide in terms of SN1 and SN2 mechanisms. (3)   
**10.6 Reaction pathways - 1 hour**   
10.6.1 Deduce reaction pathways given the starting materials and the product. (3)

**Topic 20: Organic chemistry (10 hours)**  
**20.1 Introduction - 1 hour**  
20.1.1 Deduce structural formulas for compounds containing up to six carbon atoms with one of the   
following functional groups: amine, amide, ester and nitrile. (3)   
20.1.2 Apply IUPAC rules for naming compounds containing up to six carbon atoms with one of the   
following functional groups: amine, amide, ester and nitrile. (2)   
**20.2 Nucleophilic substitution reactions - 2 hours**   
20.2.1 Explain why the hydroxide ion is a better nucleophile than water. (3)   
20.2.2 Describe and explain how the rate of nucleophilic substitution in halogenoalkanes by the hydroxide ion depends on the identity of the halogen. (3)   
20.2.3 Describe and explain how the rate of nucleophilic substitution in halogenoalkanes by the hydroxide ion depends on whether the halogenoalkane is primary, secondary or tertiary. (3)   
20.2.4 Describe, using equations, the substitution reactions of   
halogenoalkanes with ammonia and potassium cyanide. (2)   
20.2.5 Explain the reactions of primary halogenoalkanes with ammonia and   
potassium cyanide in terms of the SN2 mechanism. (3)   
20.2.6 Describe, using equations, the reduction of nitriles using hydrogen and a nickel catalyst. (2)   
**20.3 Elimination reactions - 1 hour**   
20.3.1 Describe, using equations, the elimination of HBr from bromoalkanes. (2)   
20.3.2 Describe and explain the mechanism for the elimination of HBr from bromoalkanes. (3)   
**20.4 Condensation reactions - 2 hours**   
20.4.1 Describe, using equations, the reactions of alcohols with carboxylic acids to form esters, and state the uses of esters. (2)   
20.4.2 Describe, using equations, the reactions of amines with carboxylic acids. (2)   
20.4.3 Deduce the structures of the polymers formed in the reactions of alcohols with carboxylic acids. (3)   
20.4.4 Deduce the structures of the polymers formed in the reactions of amines with carboxylic acids. (3)   
20.4.5 Outline the economic importance of condensation reactions. (2)   
**20.5 Reaction pathways - 1 hour**   
20.5.1 Deduce reaction pathways given the starting materials and the product. (3)   
**20.6 Stereoisomerism - 3 hours**   
20.6.1 Describe stereoisomers as compounds with the same structural formula but with different arrangements of atoms in space. (2)   
20.6.2 Describe and explain geometrical isomerism in non-cyclic alkenes. (3)   
20.6.3 Describe and explain geometrical isomerism in C3 and C4 cycloalkanes. (3)   
20.6.4 Explain the difference in the physical and chemical properties of geometrical isomers. (3)   
20.6.5 Describe and explain optical isomerism in simple organic molecules. (3)   
20.6.6 Outline the use of a polarimeter in distinguishing between optical isomers. (2)   
20.6.7 Compare the physical and chemical properties of enantiomers. (3)